

Conservation of Energy

6-5 The student will demonstrate an understanding of the law of conservation of energy and the properties of energy and work. (Physical Science)

6-5.4 Illustrate energy transformations (including the production of light, sound, heat, and mechanical motion) in electrical circuits.

Taxonomy level: 2.2-B Understand Conceptual Knowledge

Previous/Future knowledge: In 4th grade, students explained how electricity could be transformed into other forms of energy (including light, heat, and sound) (4-5.5). They also summarized the functions of the components of complete circuits (including wire, switch, battery, and light bulb) (4-5.6) and illustrated the path of electric currents in series and parallel circuits (4-5.7). Students have not been introduced to the term “mechanical motion” in previous grade levels. Students will further develop the concept of energy transformations in high school Physical Science (PS-6.1).

It is essential for students to know that *electrical energy* can be transformed to light, sound, heat, and mechanical motion in an electric circuit.

- An electric circuit contains a source of electrical energy, a conductor of the electrical energy (wire) connected to the energy source, and a device that uses and transforms the electrical energy.
- All these components must be connected in a complete, unbroken path in order for energy transformations to occur.

The electrical energy in circuits may come from many sources including:

- The electrical energy in a battery comes from stored chemical energy.
- The electrical energy in a solar cell comes from light energy from the sun.
- The electrical energy in outlets may come from chemical energy (burning fuels) which powers a generator in a power plant.

Electrical energy can be transformed to other forms of energy in a circuit.

Light

- Electrical energy can be transformed into light energy in an electric circuit if a light bulb is added to the circuit.
- The transformation in this case might be that chemical energy in a battery is transformed into electrical energy in the circuit which is transformed into light and heat energy in the light bulb.

Sound

- Electrical energy can be transformed into sound energy in an electric circuit if a bell, buzzer, radio, or TV is added to the circuit.
- The transformation in this case might be that chemical energy in a battery is transformed into electrical energy in the circuit which is transformed into sound energy by the buzzer.

Heat

- Electrical energy can be transformed into heat energy in an electric circuit if a toaster, stove, or heater is added to the circuit.

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- The transformation in this case might be that chemical energy from the fuel at the power plant is transformed into heat energy which is transformed into mechanical energy to turn a generator.
- The generator transforms the mechanical energy into electrical energy.
- Then the electrical energy in the circuit is transformed into heat energy in the heater.

Mechanical motion

- Electrical energy can be transformed into the energy of mechanical motion if a fan or motor is added to the circuit.
- Transformation in this case might be that chemical energy in a battery is transformed into electrical energy in the circuit which is transformed into the energy of mechanical motion by the fan or motor.

A generator in a circuit can change mechanical motion into electrical energy. The transformation in this case might be that chemical energy from the fuel at a power plant is transformed into heat energy which is transformed into mechanical energy to turn a generator. The generator transforms the mechanical energy into electrical energy. This is the source of energy in electric outlets.

It is not essential for students to know the mechanisms of energy transformation, only that energy transformations do occur. Students do not need to compare series and parallel circuits, know how to calculate power, or use Ohm's Law.

Assessment Guidelines:

The objective of this indicator is to *illustrate* energy transformations in electric circuits; therefore, the primary focus of assessment should be to give illustrations or use illustrations to show the concept of energy transformations (including the production of light, sound, heat, and mechanical motion) in electric circuits. However, appropriate assessments should also require students to *recall* that energy transformations can only occur when an electrical circuit is complete; *recognize* devices used to transfer electrical energy to another form of energy in an electrical circuit; or *infer* the types of energy transformations that would occur with specific devices.